DOCUMENT RESUME

ED 159 345 CE 016 671

TITLE	Fire Service Training. Portable Fire Extinguishers. (Revised).
INSTITUTION	North Carolina State Dept. of Community Colleges, Raleigh.
REPORT NO	FIP-3018
PUB DATE	Jun 74
NOTE	51p.; The manual for this unit is available from International Fire Service Training Association, Fire Protection Publications, Oklahoma State University, Stillwater, Oklahoma 74074 ($5.00); Transparencies for this unit are available from Robert J. Brady Company, Bowie, Maryland 20715 (Unit 3, $238.00); For related documents see CE 016 662-675
EDRS PRICE	MF-$0.83 HC-$3.50 Plus Postage.
DESCRIPTORS	Course Content; Demonstrations (Educational); Educational Programs; *Equipment; Fire Protection; *Fire Science Education; Instructional Materials; *Job Skills; Performance Based Education
IDENTIFIERS	*Fire Extinguishers

ABSTRACT

One of a set of fourteen instructional outlines for use in a course to train novice firemen, this guide covers the topic of portable fire extinguishers. Designed to be used with the Robert J. Brady Transparencies and/or the film "Portable Fire Extinguishers" and with the International Fire Service Training Association Manual No. 101, "Forcible Entry, Rope and Portable Extinguisher Practices" (see note), it refers to appropriate page or transparency numbers as guides. Specific directions are given to the instructor for demonstrating techniques and testing student proficiency, and two phases of instruction are recognized: (1) lecturing on the requirements for fire, types of fires, types of extinguishers, and their operation; and (2) demonstrating and having students use various types of extinguishers. Also, two handouts for students developed by the North Carolina Department of Community Colleges Fire Service Training are included. (An outline of the whole course covering all fourteen topics briefly is provided in the first volume of the set--CE 016 662.) (ELG)

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INTRODUCTION

In most instances, a fire may be extinguished by the proper application of the appropriate extinguishing agent. The modern portable fire extinguisher serves this purpose. Today's extinguishers have been designed for various hazards and with a very high fire killing potential. Portable fire extinguishers are first aid devices for use in extinguishing a fire in its early stage.

Firemen are not only apt to use extinguishers, many times they may be called upon to recommend to a private citizen the proper appliance to protect his home or business. There are something like ten common fire extinguishing agents. In order that a fire fighter can properly use or make recommendations on portable fire extinguishers, it is important that he know the requirements for fire, types of fires, types of extinguishers and their operation.

PRESENTATION

Instruction to fire department personnel should cover as much of the subject as possible. Because a firemen's department does not carry a pressurized water extinguisher on its truck does not mean that he will never be called upon to use or comment upon a particular type. Portable fire extinguishers are not as understood as many firemen would have us to believe.

With this in mine, a proper presentation should cover the requirements for fire, types of extinguishers, their classification, their rating, and instruction on operation. This first phase should be handled by using the lecture method in combination with transparencies and/or the film, Portable Fire Extinguishers, along with appropriate handouts.

The second phase should be demonstrated using various types of extinguishers. At least one of each type appliance should be demonstrated. Each student should have the opportunity to use an extinguisher.

OBJECTIVE

To develop the firemen's skill in the selections and operation of portable fire extinguishers. Proficiency is demonstrated when the student can identify the requirements for fire, each type of extinguisher and operate at least one appliance effectively.

REQUIRED MATERIALS

1. Portable extinguishers, one each type: soda and acid, foam, water, carbon dioxide, and ABC, purple-K and regular dry chemical.
2. Brady Transparencies on portable extinguishers.
3. Overhead projector.
4. Screen.
5. Blackboard.
6. Fuels to burn (solids and liquids).
7. Pans or barrels for flammable liquid fires.

OPTIONAL MATERIALS

1. Film, Portable Fire Extinguishers.
2. 16 MM movie projector.
3. Screen.

COURSE OUTLINE	GUIDES
I. Introduction.	
A. Purpose of portable extinguisher.	
1. First aid protection.	
2. Meet insurance requirements.	
(a) For buildings.	
(b) To meet rating bureau requirements on pumpers.	
3. Federal, state and local government requirements - particularly Occupational Safety and Health Act.	
B. Necessity for knowledge on extinguishers.	
1. Permit proper usage.	
2. Selection of suitable extinguishers for various hazards.	
3. Ability to pass on information to others.	
4. Familiarity with laws that cover portable extinguishers, especially the Occupational Safety and Health Act.	For OSHA requirements, see part 1910.156 of OSHA Standard Book
II. Four Requirements for Burning (Fire Tetrahedron).	
A. Definition - combustion, the rapid process of oxidation accompanied by the release energy in the form of heat and light.	Tetrahedron, IFSTA Manual #101, P. 133
B Oxidation - combining of oxygen with a material.	
1. Slowly - rusting of iron.	
2. Rapid - free burning.	
3. Instantaneous - explosion of dynamite.	

COURSE OUTLINE	GUIDES
C. Requirements for fire. 1. Fuel (anything that will burn). (a) Exists in three states. (1) Solid - wood, paper and coal. (2) Liquid - gasoline, alcohol and oil. (3) Gaseous - natural, acetylene and hydrogen. (b) Influences on burning rate. (1) Physical form (finely divided materials burn faster). (2) Heat conductivity - a material may conduct heat fast enough to hold the temperature below the point at which it will ignite. (3) Moisture content - will increase or decrease ignition time. 2. Oxygen (available from atmosphere). (a) Most fuels require for combustion. (1) Exceptions. a. Calcium and aluminum burn in an atmosphere of nitrogen without oxygen. b. Sodium nitrate burn in oxygen-free atmosphere.	Brady Transparencies, Unit 3, #1

COURSE OUTLINE	GUIDES
(b) 21% normal content in air.	
(c) 16% critical amount for producing flame.	
3. Heat (temperature).	
(a) Required in some degree for combustion.	
(b) Fire point - point in degrees that a flammable liquid will flash and continue to burn.	
(c) Ignition temperature - that point at which a solid ignites.	
(d) Sources.	
(1) Sparks.	
(2) Flames.	
(3) Friction.	
(4) Oxidation process.	
4. Chemical chain reaction.	IFSTA #101, P. 134
(a) Proper combination of atoms and molecules which results in fire.	
(b) Dry chemical removes this.	
(c) Sound waves used to extinguish a candle.	
NOTE: Instructors not familiar with the chemical chain reaction theory should consult one of the following text for additional	

COURSE OUTLINE	GUIDES

information: IFSTA Training Manual "Portable Extinguisher Practices", "The Fire Chief's Handbook", or "Fire Fighting Strategy and Leadership".

III. Fire Extinguishment Methods.
(In order to select the proper extinguisher, a fire fighter should know how fires are extinguished).

A. Cooling.

1. Most widely and least expensive.

2. Temperature control - involves heat absorption by extinguishing agent.

3. Water absorbs more heat per volume than any other agent.

B. Fuel removal.

1. May not be practical or possible.

2. Examples of removal.

(a) Cut off gas supply.

(b) Pump out fuel.

(c) Move piles of lumber.

(d) Dilute - such as using an emulsifying agent - as some new foams due.

C. Smothering.

1. Separating oxygen from fuel.

2. Examples.

COURSE OUTLINE	GUIDES
(a) Cover pan of burning grease with lid. (b) Use of foam. (c) Use of carbon dioxide. 3. Not practical at times. 4. Rare number of materials produce own oxygen or burn in the presence of special gases. D. Inhibition of chemical chain reaction. 1. New concept in extinguishment. 2. Certain extinguishing agents interrupt chemical reaction, i.e., dry chemical or Freon 1301. IV. Classification of Fires - Definition and Control. A. Class "A" fires. 1. Definition - fires in ordinary combustible materials such as wood, paper and cloth. 2. Principle of extinguishment - reduce the temperature of the burning material below the ignition temperature. EXAMPLE: The "quenching-cooling" effect of sufficient quantities of water or solutions containing large percentages of water. B. Class "B" fires. 1. Definition - fires in flammable petroleum products or other flammable liquids, greases, etc.	Brady Transparencies, Unit 3, #2

COURSE OUTLINE	GUIDES

2. Principle of extinguishment.

   (a) Oxygen excluding method as with foam or CO_2.

   (b) Inhibit flame chain reaction as with dry chemical.

C. Class "C" fires.

1. Definition - fires involving energized electrical equipment.

2. Principle of extinguishment.

   (a) Electrical nonconductivity of the extinguishing agent most important.

   (b) Electricity may have to be cutoff to accomplish extinguishment.

D. Class "D" fires.

1. Definition - fires involving metals such as.

   (a) Magnesium.

   (b) Titanium.

   (c) Zirconium.

   (d) Sodium.

   (e) Potassium.

COURSE OUTLINE	GUIDES
2. Principle of extinguishment - apply specially designed agents to blanket or smother. NOTE: Fires involving certain combustible metals or reactive chemicals (some are water reactive) in some cases require special extinguishing agents or techniques. For assistance on specific chemicals, refer to N.F.P.A. pamphlet, "Hazardous Chemicals Data" (No. 49M), or N.F.P.A. manual on the "Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids" (No. 235).	
V. Classification of Portable Fire Extinguishers. (Extinguishers are rated in units of protection according to their relative extinguishing potential and to the class of fires which they may be used upon).	Brady Transparencies, Unit 3, #3
A. Method of classification used by Underwriters Laboratories, Incorporated.	
1. Letter - represents class of fire which extinguisher is effective.	
(a) Class "A" for ordinary combustibles.	
(b) Class "B" for flammable liquids.	
(c) Class "C" for use on energized electrical equipment.	
(d) Class "D" for combustible metal fires.	
2. Numeral - indicates extinguishing potential.	

COURSE OUTLINE	GUIDES
(a) Class "A" fires - numeral indicates approximate extinguishing potential, i.e., 4-A extinguisher twice as effective as 2-A extinguisher.	
(b) Class "B" fires - numeral indicates area in square feet of deep layer flammable liquid that extinguisher will control.	
(c) Class "C" fires - there is no numeral.	
(1) Fires are essentially Class "A" or "B".	
(2) Extinguisher should be large enough to protect hazard.	
(d) Class "D" fires - no numeral.	
3. Extinguishers produced and classified prior to 1955.	See chart, IFSTA #101, P. 143
(a) Rating much different than today.	
(b) For conversion, see chart.	
NOTE: This chart is for use only on extinguishers classified prior to 1955. Modern extinguishers such as the dry chemical and carbon dioxide have a much higher classification, i.e., a 10-lb. dry chemical under the old system was rated 8 BC, whereas, a modern unit may carry a 40 BC classification. Always refer to the extinguisher to obtain the correct classification.	
B. Selection of suitable extinguishers.	

COURSE OUTLINE	GUIDES
1. Should be done only by qualified individual.	
2. Selection based upon.	Occupational Safety and Health Act, Part 1910.156
(a) Construction and occupancy of property.	
(b) Character of fires anticipated.	
(c) Who will use extinguishers - men or women.	
NOTE: Federal regulations are strigent in many instances, as they apply to the requirements for extirguishers. It is important that one know these requirements before making recommendations.	
VI. Distribution of Extinguishers.	
A. Facts to consider.	
1. Area to be protected.	
2. Arrangement of area.	
3. Severity of hazard.	
4. Classes of fires expected.	
5. Travel distance.	
6. Anticipated rate of fire spread.	
7. Other special factors.	
B. Occupational Safety and Health Act requirements.	

COURSE OUTLINE	GUIDES
1. Building protection - extinguishes suitable for Class "A" fires.	
2. Occupancy hazard shall be protected by the appropriate class extinguisher.	
3. Multi-class extinguishers may be used to protect both building and the occupancy hazard.	
4. Hazard classification.	Brady Transparencies, Unit 3, #4
(a) Light hazard - only small fires anticipated.	
(1) Offices.	
(2) Schools.	
(3) Churches.	
(4) Assembly halls.	
(b) Ordinary hazard - moderate fires anticipated.	
(1) Mercantile storage.	
(2) Parking garages.	
(3) Light manufacturing.	
(4) School shop areas.	
(c) Extra hazard - fires of severe magnitude expected.	
(1) Woodworking.	
(2) Auto repair.	

COURSE OUTLINE	GUIDES
(3) High piled stock warehouses. (4) Flammable liquid processes, painting and dipping etc. 5. Distribution for Class "A" hazards. (a) Shall meet the below table.	Brady Transparencies, Unit 3, #5

BASIC MINIMUM EXTINGUISHER RATING FOR AREA	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS	AREAS TO BE PROTECTED PER EXTINGUISHER		
		Light	Ordinary	Extra
1 - A	75 Ft.	3,000 Sq. Ft.	See Note (b)	See Note (b)
2 - A	75 Ft.	6,000 Sq. Ft.	3,000 Sq. Ft.	See Note (b)
3 - A	75 Ft.	9,000 Sq. Ft.	4,500 Sq. Ft.	3,000 Sq. Ft.
4 - A	75 Ft.	11,250 Sq. Ft.	6,000 Sq. Ft.	4,000 Sq. Ft.
6 - A	75 Ft.	11,250 Sq. Ft.	9,000 Sq. Ft.	6,000 Sq. Ft.

NOTE: (b) The protection requirements specified in table may be fulfilled by several extinguishers of lower rating for ordinary or extra hazard occupancies.

Have students to determine fire extinguisher requirements of various areas

(c) Travel distance shall not exceed 75 feet in any case.

(d) Floor area less than specified, at least one extinguisher of minimum size shall be provided.

(e) Larger extinguishers may be used.

6. Distribution for Class "B" hazards.

Brady Transparencies, Unit 3, #5

COURSE OUTLINE	GUIDES

(a) Shall meet the below table.

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS
LIGHT	4 - B	50 Ft.
ORDINARY	8 - B	50 Ft.
EXTRA	12 - B	50 Ft.

Have students determine fire extinguisher requirements of various areas

(b) Travel distance shall not exceed 50 feet.

(c) Two or more extinguishers of lower rating, except for foam extinguishers, shall NOT be used to fulfill requirement in table.

(d) Foam - up to three foam extinguishers may be used to fulfill requirements.

(e) Larger extinguishers may be used.

7. Class "B" hazards of appreciable depth.

(a) Required for dip tanks, etc.

(b) Determine area of tank.

(c) Provide Class "B" extinguisher with numeral rating at least equal to square feet of tank.

(d) Two or more smaller extinguishers, except foam, may not be used.

(e) Travel distance to extinguisher not to exceed 50 feet.

COURSE OUTLINE	GUIDES
(f) Requirements may be waived where automatic protection has been installed.	
8. Class "C" hazard.	
(a) Extinguishing agent suitable for use on energized electrical equipment.	
(b) Extinguisher shall be large enough to cover hazard.	
(c) Travel distance not to exceed 50 feet.	
9. Class "D" hazard.	
(a) Determine metal to be protected.	
(b) Select proper agent for type metal.	
NOTE: Some agents will be effective on one type metal fire and will react on another.	
(c) Have adequate number extinguishers available.	
(d) Extinguishers large enough for fire potential.	
C. Requirements for fire apparatus.	
1. For apparatus rated 9A or 9AA.	Fire Defense for Communities with Limited Water Suppl by N.C. Rating Bureau
(a) 2 BC rated extinguishers.	
(b) No minimum size required by rating bureau.	
(c) Recommended minimum size.	
(1) 10 lb. dry chemical.	
(2) 15 lb. CO_2.	

COURSE OUTLINE	GUIDES
2. For apparatus rated under NFPA Pamphlet #19.	NFPA Pamphlet #19
(a) Two extinguishers rated for "A, B, and C" fires required.	
(b) Standard applies to.	
(1) Pumpers.	
(2) Tankers.	
(3) Ladder trucks.	
(4) Pumper - ladder trucks.	
(5) Elevating platforms.	
(c) Minimum acceptable size.	
(1) 10 lb. dry chemical.	
(2) 15 lb. carbon dioxide.	
(3) $2\frac{1}{2}$ gallon water ext.	
VII. Using Portable Extinguishers.	
A. Standard fire pails, drums with pails, and bucket tanks.	IFSTA Manual #101, P. 150
1. Used for protection of.	
(a) Outside storage areas.	
(b) Construction sites.	
2. Sizes.	
(a) Five 12-quart water filled standard fire pails.	

COURSE OUTLINE	GUIDES
(b) Six 10-quart water filled pails.	
(c) 55-gallon drum, casks, or barrel and 3 pails attached.	
(d) 25 to 55-gallon bucket tanks with 5 or 6 buckets in water.	
3. Applicable to Class "A" fires.	
4. Protect from freezing - use calcium chloride.	
5. Servicing - as per NFPA Standard No. 10-A.	
6. Method of operation.	
(a) Carry pail to fire.	
(b) Throw or pour contents on fire.	
B. Water pump tank extinguishers.	Brady Transparencies Unit 3, #6 & 7
1. Uses.	
(a) Building protection - in areas where it would be difficult to get conventional extinguisher recharged.	IFSTA Manual #101, P. 151
(b) Back paks - brush and grass fires.	
2. Size.	
(a) $2\frac{1}{2}$ gallon.	
(b) 5 gallon.	
3. Applicable to Class "A" fires.	

COURSE OUTLINE	GUIDES
4. Stream reach 30 to 40 feet.	
5. Discharge time - 2½ gallon one minute.	
6. Protect from freezing.	
7. Hand pump operated.	
8. Servicing.	
(a) Manufacturer's instructions.	
(b) NFPA Standard No. 10-A.	
8. Operation.	
(a) Pump tank.	
(1) Double action.	Have students operate
(2) Use short continuous strokes.	
(b) Back pak type.	
(1) Usually 5 gallons.	
(2) Side handle operation or,	
(3) Sliding barrel operation.	
C. Bromotrifloromethane (Freon 1301) extinguishers.	IFSTA Manual #101, P. 152
1. Size - 2½ pounds.	
2. Applicable to Class "B and C" fires.	
NOTE: Because of lightweight, good fire killing power and lack of residue unit finding application in such areas as computer rooms.	

COURSE OUTLINE	GUIDES
3. Range - 4 to 6 feet.	
4. Discharge time - 8 to 10 seconds.	
5. Does not have to be protected from freezing.	
6. Operating principle.	
(a) Stored under pressure.	
(b) Nitrogen used as expellant agent.	
(c) Contents - Freon 1301.	
(d) Extinguishment principle.	
(1) Smothers.	
(2) Inhibits flame chain reaction.	
7. Construction.	Point out various parts
8. Servicing.	
(a) Replace cylinder.	
(b) Per manufacturer's instructions and	
(c) NFPA Standard No. 10-A.	
9. Method of operation.	
(a) Carry by handle.	Expense of recharge may prohibit use
(b) Pull pin.	
(c) Aim horn at base of flame.	

COURSE OUTLINE	GUIDES
(d) Squeeze lever.	
(e) Sweep burning surface.	
D. Stored pressure water extinguishers.	Brady Transparencies, Unit 3, #8
1. Size - $2\frac{1}{2}$ gallons.	
2. Applicable - Class "A" fires.	IFSTA Manual #101, P. 153
3. Reach - 30 to 40 feet.	
4. Discharge time - one minute.	
5. Protect from freezing.	
(a) Use loaded stream.	
(b) DO NOT use calcium chloride - will damage extinguisher.	
6. Operating principle.	
(a) Cooling effect of water.	
(b) Air expels water.	
7. Construction.	Point out parts
(a) Stainless steel.	
(b) Fiberglass - production ceased.	
8. Servicing - per instructions on label and NFPA 10-A.	Have students recharge
(a) Recharge after each use.	
(b) Check extinguisher for damage.	

COURSE OUTLINE	GUIDES
(c) Flush inside.	
(d) Fill to proper level with water or antifreeze solution.	
(e) Pressurize unit.	
(f) Replace pin and seal.	
(g) Check for pressure loss.	
(h) Hydrostatically test every five years.	
9. Method of operation.	Have students operate
(a) Carry to fire by handle.	
(b) Pull pin.	
(c) Hold hose.	
(d) Press lever.	
(e) Direct discharge at base of flame.	
(f) Use whipping motion.	
(g) Place finger in stream.	
10. Disadvantages.	
(a) Conductor of electricity.	
(b) Must protect from freezing.	
E. Soda and acid extinguishers.	Brady Transparencies, Unit 3, #10
NOTE: No longer manufactured but many still in use.	

COURSE OUTLINE	GUIDES
1. Size. (a) $1\frac{1}{4}$ gallons. (b) $1\frac{1}{2}$ gallons. (c) $2\frac{1}{2}$ gallons (standard).	IFSTA Manual #101, Pgs. 154-155
2. Applicable - Class "A" fires.	
3. Reach 30 to 40 feet.	
4. Discharge time - $2\frac{1}{2}$ gallons, approximately one minute.	
5. Protect from freezing.	
6. Operating principle. (a) Cooling effect of water. (b) Reaction of soda water and sulphuric acid. (c) Produces carbon dioxide gas which expels agent.	
7. Construction. (a) Stainless steel or brass-copper shells. (b) Soda solution contained in shell. (c) Acid suspended in cage. (d) Lead stopper. (1) Prevents moisture contamination of acid. (2) Acts as metering valve.	Point out parts

COURSE OUTLINE	GUIDES
8. Servicing - must be done yearly. (a) Per manufacturer's instructions. (b) NFPA Standard 10-A. (c) Recharging. (1) Empty extinguisher. (2) Flush unit. (3) Check for damage - gaskets. (4) Check hose for obstructions. (5) Mix soda solution and pour into extinguisher to proper level. (6) Remove cap from acid bottle. (7) Place acid bottle in cage. (8) Place cage in top of unit. (9) Replace top. (10) Attach recharge tag. (d) Hydrostatically test every five years. (e) Recharge after use.	Have students recharge
9. Method of operation. (a) Carry to fire in upright position. (b) Hold hose.	Have students to operate

COURSE OUTLINE	GUIDES
(c) Grab bottom handle with other hand.	
(d) Invert extinguisher.	
(e) Direct discharge at base of flame.	
NOTE: If unit does not work immediately, bump top on floor to free lead stopple. If unit still does not work, throw away. Nozzle may be obstructed which results in pressure build up and possible failure of extinguisher shell.	
10. Disadvantages.	
(a) Must be recharged yearly.	
(b) Conductor of electricity.	
(c) Must be protected from freezing.	
F. Soda - acid wheeled units.	Basically an oversized hand unit
NOTE: Discuss only if this type unit located in area or at specific location.	
1. Size.	
(a) 17 gallon.	
(b) 33 gallon.	
2. Applicable to Class "A" fires.	If applicable, have students operate and recharge
3. Stream reach - up to 50 feet.	
4. Discharge time - up to three minutes.	
5. Protect from freezing.	

COURSE OUTLINE	GUIDES
6. Hose length 25 to 50 feet.	
7. Operation - in accordance with instructions on unit.	
G. Water extinguishers (cartridge operated).	Brady Transparencies, Unit 3, #9
1. Sizes 1 3/4 to 2 1/2 gallons.	
2. Applicable to.	
(a) Class "A".	
(b) Class "B" - when unit contains loaded stream.	See IFSTA Manual #101, Pgs. 156 and 157
3. Stream reach 30 to 40 feet.	
4. Discharge time - $2\frac{1}{2}$ gallons, one minute.	
5. Protect from freezing.	
(a) Use loaded stream.	
(b) Do not use calcium chloride.	
6. Operating principle.	
(a) Shell contains water or antifreeze solution.	
(b) Cartridge in sliding tube or,	
(c) Punctured from outside.	
(d) Punctured when inverted by bumping.	
(e) Pressure from cartridge expels water.	

COURSE OUTLINE	GUIDES
7. Construction.	Point out parts
(a) Stainless steel.	
(b) Copper - brass.	
8. Servicing.	
(a) After use.	Have students recharge
(b) Per manufacturer's instructions and,	
(c) NFPA Standard No. 10-A.	
(d) Method.	
(1) Empty extinguisher.	
(2) Flush.	
(3) Check for damage - gaskets, if shell damaged, test it.	
(4) Refill with water or antifreeze to proper level.	
(5) Replace cartridge.	
(6) Screw on top.	
(7) Replace tag.	
(e) Hydrostatically test every five years.	
9. Method of operation.	

COURSE OUTLINE	GUIDES
(a) Carry to fire in upright position.	
(b) Hold hose and ring top with one hand.	
(c) Grasp bottom handle.	Have students operate
(d) Invert extinguisher.	
(e) Bump top on floor.	
(f) Direct stream as base of flame.	
(g) Use finger to form spray.	
(h) Turn right-side up to stop discharge.	
10. Explain disadvantages.	
(a) Conducts electricity.	
(b) Cannot shut on and off.	
(c) Must be protected from freezing.	
H. Wheeled water extinguishers.	IFSTA Manual #101, P. 157
1. Size.	
(a) 17 gallons.	
(b) 33 gallons.	
2. Applicable to.	
(a) Class "A" fires.	
(b) Class "B" - when unit contains "loaded stream".	

COURSE OUTLINE	GUIDES
3. Stream reach - 50 feet maximum.	
4. Discharge time - three minutes maximum.	
5. Protect from freezing - unless contains antifreeze.	
6. Operation - in as much as the various types may vary in their operation, consult the directions on the particular unit for this information.	
7. Servicing - consult manufacturer's directions.	
I. Carbon dioxide extinguishers.	Brady Transparencies, Unit 3, #12
1. Sizes 2 thru 26 pound units.	
2. Applicable to Class "B and C" fires.	
3. Reach 3 to 8 feet.	
4. Discharge time - 15 to 30 seconds.	IFSTA Manual #101, Pgs. 158-159
5. Do not have to protect from freezing.	
6. Operating principle.	
(a) Contains carbon dioxide gas.	
(b) Smothers fire.	
(c) Stored under its own pressure.	
(d) Stored as liquid.	
(e) Pressure 800 to 900 pounds at ordinary room temperature.	
(f) Critical pressure 88 degrees.	

COURSE OUTLINE	GUIDES
7. Construction.	Point out parts
(a) High pressure cylinder.	
(b) Valve.	
(c) Safety disk.	
(d) hose.	
(e) horn.	
8. Servicing.	
(a) Per manufacturer's instructions and,	
(b) NFPA Standard No. 10-A.	
(c) Requires special equipment.	
(d) Weigh extinguisher every six months.	Discuss recharge procedure
(e) Perform hydrostatic test every five years.	
(f) Recharge after use.	
9. Method of operation.	
(a) Carry by top handle to fire.	Have students operate
(b) Pull pin.	
(c) Hold horn.	
(d) Squeeze level.	
(e) Direct discharge at base of flame.	

COURSE OUTLINE	GUIDES
(f) Use sweeping motion. (g) Coat glowing surfaces. (h) Do not handle snow. 10. Advantages - excellent for protection of areas such as telephone or computer equipment where residue from dry chemical or water could cause heavy damage. 11. Disadvantages. (a) Limited effect on Class "A" fires. (b) Low rating as compared to dry chemical extinguishers. i.e., 10 lb. carbon dioxide rated 5 BC. 10 lb. chemical (dry) rated 20 BC or higher. J. Wheeled carbon dioxide units. 1. Sizes. (a) 25 lb. units. (b) 50 lb. units. (c) 75 lb. units. (d) 100 lb. units. 2. Applicable to Class "B and C" fires. 3. Discharge reach - 8 to 12 feet.	If applicable, have students operate a wheeled unit

COURSE OUTLINE	GUIDES
4. Discharge time - 50 to 60 seconds.	
5. Operation - consult directions on particular extinguisher for its proper operation.	
K. Foam extinguishers.	Brady Transparencies, Unit 3, #11
NOTE: Production ceased by most companies, but many still in use.	IFSTA Manual #101, Pgs. 160-161
1. Size.	
(a) $1\frac{1}{4}$ to 5 gallons.	
(b) $2\frac{1}{2}$ gallons - standard size.	
2. Applicable.	Not for electrical fires - agent conducts electricity
(a) Class "A" fires.	
(b) Class "B" fires.	
3. Stream reach - 30 to 40 feet.	
4. Discharge time - $2\frac{1}{2}$ gallons, approximately one minute.	
5. Protect from freezing.	
(a) In heated area or enclosure.	
(b) Do not add antifreeze agents to foam solution.	
6. Operating principle.	
(a) Reaction between aluminum sulphate and bicarbonate of soda.	

COURSE OUTLINE	GUIDES
(b) Foam stabilizing agent added to toughen bubbles.	
(c) Reaction produces carbon dioxide gas which expels agent.	
7. Extinguishment principle.	
(a) Cooling effect of water.	
(b) Smothering effect of foam blanket.	
8. Construction.	Point out parts
(a) Stainless steel or brass-copper shells.	
(b) Outer shell - bicarbonate of soda.	
(c) Inner shell - aluminum sulphate.	
(d) Lead stopper - prevents moisture contamination.	
(e) Hose.	
(f) Ring top.	
9. Servicing - must be done yearly.	Have students recharge
(a) Per manufacturer's instructions and,	
(b) NFPA Standard 10-A.	
(c) Recharging.	
(1) Empty extinguisher.	
(2) Flush unit.	
(3) Check for damage - gaskets, shell and hose.	

COURSE OUTLINE	GUIDES
(4) Check hose for obstructions. (5) Mix solution for outer chamber and pour into outer chamber. (6) Mix and pour solution into inner chamber. (7) Replace lead stopper. (8) Place inner chamber in extinguisher. (9) Replace top. (10) Attach recharge tag. (d) Hydrostatically test every five years - test pressure 300 or 375 PSI.	
10. Method of operation. (a) Carry to fire in upright position. (b) Hold hose. (c) Grab bottom handle with other hand. (d) Invert extinguisher. (e) For Class "A", direct discharge of base of flame.. (f) For Class "B" fires, direct stream against wall of container - above liquid level and permit foam to float over liquid surface or, (g) At some distance direct stream so foam lightly falls on burning liquid.	Have students operate

COURSE OUTLINE	GUIDES
NOTE: If unit does not work immediately, bump top on floor to free lead stopper. If unit still does not work, throw away. Nozzle may be obstructed which results in pressure build up and possible failure of extinguisher shell.	
11. Disadvantages.	
(a) Must be recharged yearly.	
(b) Conductor of electricity.	
(c) Must be protected from freezing.	
(d) Very messy.	
(e) Low Class "B" rating for size.	
L. Wheeled foam units.	Basically an over-sized hand unit
1. Size.	
(a) 17 gallons (20 gallon unit).	IFSTA Manual #101, P. 161
(b) 33 gallons (40 gallon unit).	
2. Applicable to.	If applicable, have students operate and recharge
(a) Class "A" fires.	
(b) Class "B" fires.	
3. Stream reach-up to 50 feet.	
4. Discharge time - up to three minutes.	
5. Protect from freezing.	

COURSE OUTLINE	GUIDES
6. Hose length - 25 to 50 feet.	
7. Operation - in accordance with instructions on unit.	
M. Dry chemical extinguishers.	IFSTA Manual #101, Pgs. 162-165
1. Types of agents.	
(a) Ordinary base dry chemical.	
(1) Contains sodium bicarbonate.	
(2) Moisture resistant and free flowing.	
(3) Effective on "B and C" fires.	
(4) Only slightly effective on Class "A" fires.	
(b) Potassium bicarbonate (Purple-K).	
(1) Moisture resistant and free flowing.	
(2) Effective on "B and C" fires.	
(3) Highly effective on Class "B" fires.	
(4) Slightly effective on Class "A" fires.	
(c) Mono-ammonium phosphate.	
(1) Moisture resistant and free flowing.	
(2) Effective on Class "A, B and C" fires.	
(3) Only dry chemical rated for Class "A" fires.	

COURSE OUTLINE	GUIDES
2. Pressurized extinguishers.	IFSTA Manual #101, P. 165
(a) Size 2 to 30 pounds.	
(b) Discharge reach 5 to 20 feet.	
(c) Discharge time - 10 to 25 seconds.	
(d) Do not have to protect from freezing.	
(e) Construction.	Point out parts
(1) Shell - mild steel, stainless steel, or aluminum.	
(2) Valve assembly - gauge.	
(3) "O" ring.	
(4) Hose.	
(f) Operation principle.	
(1) Agent expelled by dry air or inert gas - usually nitrogen.	
(2) Not dependent on chemical action.	
(g) Extinguishment principle.	
(1) BC agents inhibits flame chain reaction.	
(2) ABC agents when used on Class "A" materials - smothers.	
(h) Method of operation.	
(1) Carry to fire.	Have students operate

COURSE OUTLINE	GUIDES
(2) Pull pin.	
(3) Hold hose in hand.	
(4) Squeeze discharge lever.	
(5) Direct discharge at base of flame.	
(6) Use sweeping motion.	
(7) Cover hot spots with agent.	
(i) Servicing.	
(1) Recharge after use.	
(2) Per manufacturer's instructions.	
(3) Inspect monthly.	
(4) Thorough inspection yearly.	
(5) Hydrostatically test 5 or 12 years depending on type shell.	
3. Cartridge operated units.	Brady Transparencies, Unit 3, #13
(a) Size 2 to 30 pounds.	
(b) Discharge reach 5 to 20 feet.	IFSTA Manual #101, P. 163
(c) Discharge time - 10 to 25 seconds.	
(d) Do not have to protect from freezing.	
(e) Construction.	Point out parts
(1) Shell - mild steel, stainless steel, or aluminum.	

COURSE OUTLINE	GUIDES
(2) Cartridge.	
(3) Cartridge puncture assembly.	
(4) Pick-up tube.	
(5) Hose and nozzle.	
(f) Operation principle - cartridge pressurizes shell, thus expelling agent.	
(g) Extinguishment principle.	
(1) BC agents inhibits flame - chain reaction.	
(2) ABC agents when used on Class "A" materials - smothers.	
(h) Method of operation.	Have students operate
(1) Per manufacturer's instructions.	
(2) Direct discharge at base of flame.	
(3) Use sweeping motion.	
(4) Cover hot spots with agent.	
(i) Servicing.	
(1) Recharge after use.	
(2) Per manufacturer's instructions.	
(3) Inspect monthly.	
(4) Weigh cartridge every six months.	
(5) Inspect thoroughly yearly.	

COURSE OUTLINE	GUIDES
N. Extinguishers and powders for metal fires.	When applicable, describe and have students to use
1. Extinguishers with agents designed to control a specific type metal fire.	
2. Agents not effective on all types of metal fires.	
3. Agent should be provided for specific type hazard.	
4. For application, refer to the particular manufacturer's instructions.	
O. Wheeled dry chemical units.	
1. Size 75 to 350 pounds.	
2. Applicable to.	
(a) Class "B and C" fires.	When applicable, describe and have students to use.
(b) Class "A or D" when noted.	
3. Discharge reach - 10 to 45 feet.	
4. Discharge time - 20 seconds to 2 minutes.	
5. Hose length - 50 to 100 feet.	
6. Operation - per manufacturer's instructions.	
7. Rating - may be as high as 320 BC.	
P. Vaporizing liquid extinguishers.	
1. Size - 1 quart to 3 gallons.	

COURSE OUTLINES	GUIDES
2. Applicable to Class "B and C" fires.	
3. Reach - 20 to 30 feet.	
4. Discharge time - 40 seconds to 2 minutes.	
5. Do not have to protect from freezing.	
6. Operating principle.	
(a) Contains vaporizing liquid.	
(1) Carbon tetrachloride.	
(2) Chlorobromomethane.	
(3) Others.	
(b) Smothers fire.	
(c) Expelling methods.	
(1) Hand pump.	
(2) Pressurized.	
7. Construction.	
8. Servicing - per manufacturer's instructions.	
9. Method of operation.	
NOTE: Vaporizing liquid extinguishers are not approved under OSHA. In addition, when used on fires, particularly hot metal, some of these agents decompose forming hydrochloric acid and phosgene gas. Fumes breathed while using these extinguishers in an enclosed place can be fatal.	Describe hazards

COURSE OUTLINE	GUIDES
Q. Review of extinguishers.	Brady Transparencies, Unit 3, #14 and 15
VIII. Installation and Inspection.	
A. Marking extinguishers.	
1. Extinguisher itself.	
(a) Use.	
(1) Decals - large enough to be readily visible.	IFSTA Manual #101, Pgs. 169-170
(2) Paint.	
(b) Indicate.	
(1) Class of fire extinguisher suitable for.	
(2) Multiple markings.	
(3) The extinguisher's number.	
2. Extinguisher location.	
(a) Decals.	
(b) Paint.	
3. Symbols to use.	
(a) Class "A" - "A" in green triangle.	
(b) Class "B" - "B" in red square.	
(c) Class "C" - "C" in blue circle.	
(d) Class "D" - "D" in yellow star.	

COURSE OUTLINE	GUIDES
B. Installing and placing extinguishers.	Reference: OSHA 1910.157 (a) (5)
1. Wall mountings.	
(a) Height.	
(1) Extinguishers not exceeding 40 pounds - top not over 5 feet above floor.	
(2) Extinguishers over 40 pounds - top not over $3\frac{1}{2}$ feet above floor.	
(b) Hangers.	IFSTA Manual #101, P. 171
(1) Hook.	
(2) Clamp type.	
(c) Mounting procedure.	
2. Fire apparatus mountings.	
(a) Accessible location.	
(b) Mount in compartment if possible.	
(c) In the case of dry chemical, check for paking.	
3. Car and truck mountings.	
(a) Accessible location.	
(1) Passenger compartment.	
(2) Trunk.	
(3) Other protected locations.	

COURSE OUTLINE	GUIDES
(b) Types of brackets. NOTE: Avoid cab mounting of carbon dioxide or vaporizing liquid fire extinguishers. 4. Boat mounting. (a) Accessible location. (b) Outside of compartment in which it might be used. 5. Home mounting. (a) Accessible location. (b) Kitchen areas - away from stove. C. Inspection of extinguishers. 1. Schedule period. (a) Monthly. (b) Yearly - thorough inspection/recharge. 2. Items to check. (a) Accessibility. (b) Proper location. (c) Check tag - date last recharge or inspection. (d) Nozzle for obstructions. (e) Corrosion. (f) Mechanical damage.	Forms IFSTA Manual #101, P. 174

COURSE OUTLINE	GUIDES
(g) Lockpin and seal. (h) Determine if full. (1) Water level. (2) Correct pressure. (3) Weight. (i) Hose and couplings. (j) Check horns for cracks, dirt, or grease accumulations. 3. Date and initial tag.	

NORTH CAROLINA DEPARTMENT OF COMMUNITY COLLEGES
FIRE SERVICE TRAINING

Portable Fire Extinguishers

I. Requirements for Fire (Fire Tetrahedron).

A. Fuel.

1. Gaseous.
2. Liquid.
3. Solid.

B. Oxygen.

C. Heat.

D. Chemical chain reaction.

II. Extinguishing Methods.

A. Cooling.

B. Fuel removal.

C. Smothering.

D. Inhibition of chemical chain reaction.

III. Classification of Fires.

A. Class "A": fires involving ordinary combustible materials such as wood, cloth or paper.

B. Class "B": fires involving flammable liquids, greases and gases.

C. Class "C": fires involving energized electrical equipment.

D. Class "D": fires involving combustible metals such as magnesium, titanium, zirconium, sodium and potassium.

IV. Extinguisher Classification.

A. Letter - indicates the class of fire which the extinguisher is effective on.

B. Numeral.

1. Class "A" rating - numeral indicates relative fire extinguishing potential of various size extinguishers, e.g., a 4-A extinguisher can be expected to extinguish twice as much fire as a 2-A extinguisher.

2. Class "B" rating - numeral is an approximate indication of the square-foot area of deep layer flammable liquid fire which the extinguisher can extinguish.

3. Class "C" rating - no numeral used.

4. Class "D" rating - no numeral used.

V. Hazard Classification.

A. Light hazard - areas where the amount of combustibles or flammable liquids present is small, e.g., offices, schoolrooms, churches, assembly halls, etc.

B. Ordinary hazard - areas where moderate size fires can be expected, e.g., mercantile storage, auto showrooms, parking garages, light manufacturing, school shop areas, etc.

VI. Distribution of Extinguishers.

A. For Class "A" hazards.

BASIC MINIMUM EXTINGUISHER RATING FOR AREA	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS	AREAS TO BE PROTECTED PER EXTINGUISHER		
		Light	Ordinary	Extra
1 - A	75 Ft.	3,000 Sq. Ft.		
2 - A	75 Ft.	6,000 Sq. Ft.	3,000 Sq. Ft.	
3 - A	75 Ft.	9,000 Sq. Ft.	4,500 Sq. Ft.	3,000 Sq. Ft.
4 - A	75 Ft.	11,250 Sq. Ft.	6,000 Sq. Ft.	4,000 Sq. Ft.
6 - A	75 Ft.	11,250 Sq. Ft.	9,000 Sq. Ft.	6,000 Sq. Ft.

B. For Class "B" hazards.

1. By hazard.

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS
LIGHT	4 - B	50 Ft.
ORDINARY	8 - B	50 Ft.
EXTRA	12 - B	50 Ft.

2. For dip or open vats and tanks.

(a) One numeral of fire extinguishing potential required for each square-foot of flammable liquid surface of the largest tank hazard in the area.

(b) Two or more extinguishers of lower rating, except for foam, shall not be used.

(c) Travel distance not to exceed 50 feet.

C. For Class "C" hazards.

1. Extinguishers shall be non-conductors of electricity.

2. Extinguisher size based upon the severity of fire anticipated.

NORTH CAROLINA DEPARTMENT OF COMMUNITY COLLEGES
FIRE SERVICE TRAINING

Portable Fire Extinguishers

Throughout the United States, unsafe fire extinguishers have become a serious problem. More people are realizing that fire extinguishers used properly at the start of a fire are extremely effective. Improved extinguishing agents discharged at higher rates have made extinguishers much more effective, and at the same time more dangerous when they do not receive proper maintenance. Greater use of fire extinguishers has manifested widespread--and sometimes tragic--ignorance of what constitutes proper servicing of fire equipment.

There are six causes of unsafe extinguisher shells:

1. Damaged shells.
2. Internal corrosion.
3. External corrosion.
4. Metal fatigue.
5. Overcharging or undercharging.
6. Improper agents.

The force on the bottom of a $2\frac{1}{2}$ gallon pressurized water extinguisher at 100 PSI is 3,700 pounds, and that the pressure on the bottom of a 10-pound carbon dioxide extinguisher is somewhere in the neighborhood of 28,000 pounds. In other words, when a pressure rupture occurs, extinguisher shells can become missles. Even veterans in the extinguisher business are astonished at the force generated when a pressurized extinguisher "blows".

At intervals not exceeding those specified in the following paragraphs, extinguishers shall be hydrostatically tested. The first hydrostatic retest may be conducted between the fifth and sixth years for those with a designated test interval of five years.

OCCUPATIONAL SAFETY AND HEALTH ACT
HYDROSTATIC TEST INTERVAL FOR EXTINGUISHERS

Extinguisher Type	
Soda-Acid	5
Cartridge-Operated Water and/or Antifreeze	5

Storage-Pressure Water and/or Antifreeze 5

Wetting Agent 5

Foam 5

Loaded Stream 5

Stored-Pressure Vaporizing Liquid 5

Dry Chemical Extinguishers with Stainless Steel Shells, or Soldered-Brass Shells 5

Carbon Dioxide Extinguishers 5

Dry Chemical Extinguishers with Brazed Brass Shells, Mild-Steel or Aluminum Shells 12

Bromotrifluouremethane 12

Dry Powder Extinguishers for Metal Fires 12

Before loss of life or serious injury occurs from unsafe fire extinguishers, have it tested.